In the Claims:

1 - 66. (cancelled)

67. (currently amended) A material discrimination system including a high energy X-ray source, a first detector component in the form of a thin scintillation crystal for registering an amount of energy deposited by an X-ray that is essentially independent of the X-ray energy, a low-Z converter located after this crystal to stop electrons produced by X-ray interactions downstream of the thin crystal from being significantly back scattered into the thin crystal and prevent electrons leaving the thin crystal from returning and depositing more energy in the thin crystal, and a thicker <u>one-piece</u> downstream scintillation crystal, wherein the low-Z converter is situated between the thin crystal and the thicker crystal.

68. (previously presented) A material discrimination system as claimed in claim 67, wherein the low-Z converter is formed of aluminium.

69 - 72 (cancelled)

73. (previously presented) A material discrimination system as claimed in claim 67, wherein behind the low-Z converter is located a high-Z, high density converter.

74 - 75. (cancelled)

76. (previously presented) A material discrimination system as claimed in claim 73, where the high-Z converter is formed of tungsten.

77. (cancelled)

78. (cancelled)

79. (currently amended) A material discrimination system as claimed in claim ~~78~~ <u>67</u>, wherein each crystal is read out by a pair of photodiodes or pair of fibres.

80. (currently amended) A material discrimination system as claimed in claim 79, wherein signals from all such pairs of read out devices are added. ~~which increased the effective energy of the high energy X-ray component that is registered, and hence the magnitude of the material discrimination effect.~~

81. (currently amended) A material discrimination system as claimed in claim ~~78~~ 67, wherein an absorber is located at the rear of a detector assembly~~ to stop electrons produced by X-rays which carry on downstream and scatter in any structure to the rear of the apparatus from reaching the rear crystal of the detector array.~~

82. (previously presented) A material discrimination system as claimed in claim 81, wherein the absorber is formed of aluminium.

83. (currently amended) A material discrimination detector for X-ray inspection using high energy X-rays including ~~in which~~ a thin front crystal having two opposite side faces, wherein the crystal is read out from each side face by a photodiode, or optical fibre, and the output signals from the two opposite side faces of the crystal are added, so as to prevent any left/right asymmetry in an output signal.

84 - 85. (cancelled)

86. (currently amended) An X-ray inspection/material discrimination system detector comprising a front thin crystal and a rear thick one-piece crystal, wherein the latter is read out by a plurality of read out devices which sample at different depths in the beam direction, and the signals from the different sampling devices are added ~~to represent a high energy X-ray component~~.

87. (currently amended) A detector as claimed in claim 86, wherein outputs from opposite sides of the rear crystal are combined ~~to prevent left/right asymmetry~~.

88 - 91. (cancelled)

92. (previously presented) A detector as claimed in claim 87, wherein the crystals are read out by optical fibres or photodiodes.

93. (currently amended) A material discrimination detector for use in an X-ray discrimination system for X-ray inspection using high energy X-rays including separate front and rear scintillation crystals ~~which~~ and a low-Z converter between the front and rear crystals, wherein the front and rear crystals are cut from the same ingot of material ~~in order to provide matched performance~~.

94 - 95. (cancelled)

96. (previously presented) A detector as claimed in claim 93, wherein the crystal material is CsI.

97. (currently amended) A material discrimination system for X-ray inspection using high energy X-rays which includes a Linac for generating high energy X-rays, a detector, and a detector read-out system, means for synchronising the read-out system with each Linac pulse, with one read-out cycle for each pulse, and means for selectively triggering the Linac on a Linac pulse, wherein the Linac is triggered on each alternate pulse only, wherein one read-out cycle is performed for each pulse, and signals generated during read-out cycles for pulses on which the linac is not triggered correspond to background noise and crystal persistence and are subtracted from signals generated during read-out cycles for pulses on which the Linac is triggered. ~~wherein the read-out system also samples the output from crystals of the detector between each Linac pulse, so as to provide signals indicative of noise and crystal persistence.~~

98 - 106. (cancelled)

107. (currently amended) A method of calibrating a material discrimination system for X-ray inspection using high energy X-rays including a Linac in which the channels are normalised, wherein calibration is performed using a step wedge of absorbing material with increments of thickness chosen to yield fixed decrements of transmission between 90% and 10%, the method comprising ~~system as claimed in claim 103, involving~~ moving the step wedge across the X-ray

beam and determining the average signal value vs. step thickness, for use as a base level for channel to channel normalisation.

108. (previously presented) A method of calibrating a system as claimed in claim 107, wherein the step wedge is formed from PTFE.

109. (cancelled)

110. (cancelled)

111. (currently amended) A method of testing for the presence of a material whose effective Z is different depending on whether high or low energy X-rays are employed, comprising the steps of inspecting an object under test using high energy X-rays <u>having energies greater than 1 MeV</u> and noting the effective Z of the constituents of the object, inspecting it using low energy X-rays <u>having energies of approximately 100keV</u> and noting the effective Z of its constituents, comparing the values of Z obtained from the two tests for the each identified constituent in the object, and using a look-up table of Z ratios for the two X-ray energies to assist in determining the identity of each constituent.